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CLAIMS

[Claim(s)]

[Claim 1] It has the developer support driven so that a front face may move, and the developer feed zone material driven so that a front face may contact and move to a developer support front face. In the developer which forms the latent image on latent-image support into a visible image with the developer supplied on developer support by developer feed zone material The thing which holds a charge alternatively and by which much minute electric fields may be formed on a front face as this developer support is used. It sets up so that it may move in this direction mutually in the contact section with a developer support front face in the migration direction of a developer feed zone material front face. The layer specification-part material which equalizes the layer of the developer on the developer support front face which passed this contact section The developer characterized by having prepared so that a free edge might become the downstream from the end face section in the direction of developer support surface migration, and making a developer support front face carry out the pressure welding of this free edge with 10 thru/or the linear pressure of 50 gram-weight/centimeter.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the developer adopted as image formation equipments, such as a copying machine, facsimile, and a printer, and relates to stabilization of toner electrification in the developer using an one component system developer in detail.

[0002]

[Description of the Prior Art] In the image formation equipment which forms an electrostatic latent image on latent-image support, and visualizes this with a developer, the developer using points, such as a miniaturization of a developer, low-cost-izing, and high-reliability, to an one component system developer (henceforth a toner) is advantageous. Moreover, since it is highly transparent for colorizing, it is advantageous to use a nonmagnetic toner. And in order to give a predetermined charge to a toner and to supply the development field which is the opposite section with latent-image support, the developer which has the developer support driven so that a front face may move the opposite section with latent-image support, and the developer feed zone material which supplies a toner to this developer support front face is known. For example, it arranges so that the pressure welding of the developing roller of resistance (109-1011-ohmcm) and the sponge roller which consists of polyurethane as developer feed zone material may be carried out to JP,61-42672,A while having a float electrode as developer support, and the thing which makes it rotate, respectively so that a mutual front face may move to hard flow in both pressure-welding section is indicated. In order to regulate the toner coating weight on a developing roller to the specified quantity, the blade as a stratification member which carries out a pressure welding to a developing roller by the predetermined contact force is also prepared in this developer. Frictional electrification of the toner conveyed in both pressure-welding section by rotation of a sponge roller is carried out in this pressure-welding section, and it is made to adhere to a developing-roller front face in this developer. And the thickness of the toner layer which consists of a toner adhering to a front face is regulated with a blade, and the toner layer of the specified quantity is formed on a developing roller. And a toner layer is conveyed in the contact section with the photo conductor as latent-image support by rotation of a developing roller, and the electrostatic latent image on a photo conductor is developed.

[0003]

[Problem(s) to be Solved by the Invention] Here, the optimal amount of toner electrifications and toner coating weight of a 1 component development method, for example, a nonmagnetic 1 component development method, are explained. The amount of toner electrifications has desirable 5-10microc/g in the amount of average electrifications, and it is desirable for the toner of comparatively low electrification with which the amount distribution of toner electrifications moreover produces the Sharp nature, and a fall and greasing of resolution to be little stable distribution. On the other hand, as for the toner coating weight on a developing roller, it is desirable on latent-image support that it is that from which about two 0.5 - 0.7 mg/cm toner coating weight is obtained on about two 0.6 - 1.0 mg/cm toner coating weight and a transfer paper. The toner coating weight on this latent-image support and a transfer paper is influenced by not only the toner coating weight on a developing roller but the relative velocity

of the latent-image support and the developing roller in a development field.

[0004] However, according to the conventional developer, since one layer and coating weight have few toner layers on a developing roller, the amount of electrifications of the toner conveyed to a development field is 5-15microc/g extent in the amount of average electrifications, but The toner coating weight on a developing roller is 0.2 - 0.8 mg/cm², and in order to obtain the toner coating weight of a request in the above-mentioned latent-image support superiors, it needs to set up the speed of a developing roller by 2 to 4 times the speed of latent-image support. Thus, since the lack of toner coating weight on a developing roller is covered, in setting up rotation of a developing roller highly, when improvement in the speed of image formation speed is not only difficult, but develops the solid section, it also generates the phenomenon of the "toner back end approach" to which the concentration of the back end section of an image becomes high. Although there is no problem by monochrome image that this phenomenon is big, in a color picture, in order to penetrate a toner and to carry out vision of the color, concentration becomes deep in the back end section, and, especially in the case of a heavy image, there is fault of becoming different colors.

[0005] Therefore, in order to obtain desired toner coating weight in latent-image support superiors, without generating the phenomenon of such "toner back end approach", while bringing the speed of a developing roller close to the speed of latent-image support, that is, bringing it close to uniform development, it is required to make [many] toner coating weight on a developing roller as compared with the former. In order to secure mostly sufficient toner coating weight on latent-image support or a transfer paper in uniform development, specifically, it is necessary to make toner coating weight on a developing roller into 1.0 mg/cm² at least by the contact developing-negatives method with sufficient development effectiveness by the non-contact developing-negatives method at least 0.8 mg/cm² and development effectiveness are bad. In order to obtain the toner coating weight on such a developing roller, it must be made the toner thickness more than two-layer.

[0006] If it is only for making it the toner thickness more than two-layer here, setting **** is good weakness in the contact pressure of the above-mentioned blade. However, in the developer concerning the above-mentioned conventional example, since the front face where the hand of cut of a developing roller and a sponge roller is mutual in both pressure-welding section moves to hard flow, the non-charged toner from the toner hold section is also supplied to the developing-roller surface part which passed this pressure-welding section with a sponge roller. For this reason, many toners which have not been charged are contained in the management of the toner layer on the developing roller which invades into the blade contact section. Therefore, the amount distribution of electrifications of the toner on the developing roller which passed the blade contact section is the range below 10microc/g, and becomes what moreover contained the non-charged toner and the reverse electrification toner. This non-charged toner etc. has bad development transition, and it also becomes the cause of natural complexion dirt or resolution degradation.

[0007] Thus, it has been the biggest technical problem when enabling uniform development for improvement in the speed of image formation speed, or "toner back end" prevention to form the multilayer toner layer more than the bilayer of amount c/g of 5-10micro of average electrifications by which the electrification distribution which all the toners of the management of the toner layer on a developing roller are also charged, and does not have a non-charged toner was stabilized on a developing roller.

[0008] In addition, even if there are too many amounts of adhesion toners on a developing roller, fault produces them. That is, if this amount of adhesion toners becomes two or more 2.0 mg/cm, a greasing and the fault of the fall of resolution will occur regardless of the amount of toner electrifications. moreover -- since it will usually (ordinary temperature normal relative humidity) compare, the amount of toner electrifications will rise and a toner will adhere in developer support strongly if a perimeter environment changes and it becomes a damp environment (it is 15%RH for example, at 10-degreeC), the toner amount of supply is superfluous -- becoming -- the coating weight on a roller -- increasing -- the above -- it is easy to exceed a proper amount. For this reason, the image fluctuation by the environment poses a big problem. Moreover, with the conventional configuration, about the layer

specification-part material which contacts developer support, since the contact pressure was comparatively high, the ingredient which can be used as a stratification member from a viewpoint of reinforcement or a mold-release characteristic had a limit.

[0009] It is offering the one component system developer which this invention's is made in view of the above troubles, and the place made into the purpose stabilizes for it and forms a toner layer with the suitable uniform amount in which a non-charged toner's has the desired amount of electrifications few on developer support, and can be supplied to latent-image support.

[0010]

[Means for Solving the Problem] The developer support driven so that a front face may move this invention, in order to solve the above-mentioned technical problem, In the developer which forms the latent image on latent-image support into a visible image with the developer which has the developer feed zone material driven so that a front face may contact and move to a developer support front face, and was supplied on developer support by developer feed zone material The thing which holds a charge alternatively and by which much minute electric fields may be formed on a front face as this developer support is used. It sets up so that it may move in this direction mutually in the contact section with a developer support front face in the migration direction of a developer feed zone material front face. The layer specification-part material which equalizes the layer of the developer on the developer support front face which passed this contact section It prepares so that a free edge may become the downstream from the end face section in the direction of developer support surface migration, and it is characterized by making a developer support front face carry out the pressure welding of this free edge with 10 thru/or the linear pressure of 50 gram-weight/centimeter.

[0011]

[Function] In this invention, the one component system developer from a developer storage means is conveyed to the contact section with developer support by developer feed zone material, and frictional electrification of the developer is carried out in this contact section. Since both front faces move in this direction in both contact section in the migration direction of a developer feed zone material front face and a developer support front face at this time, the non-charged developer from the toner hold section is not directly supplied to the developer support front face which passed this contact section by developer feed zone material. Therefore, only the developer fully charged in the frictional electrification in this contact section on the developer support front face which passed this contact section is supported with a laminating condition on this front face by the minute electric field near the developer support front face. And the developer layer on the developer support which passed this contact section is made into homogeneity by the layer specification-part material by which the pressure welding of the free edge is carried out to the developer support front face with 10 thru/or the linear pressure of 50 gram-weight/centimeter, and also when the amount of developers on the developer support which passed this contact section increases by change of a perimeter environment etc. by this, it is made proper developer coating weight. That contact pressure to the developer support of this layer specification-part material is comparatively made to low voltage like 10 thru/or 50 gram-weight/centimeter here By driving so that a front face may move developer support and developer feed zone material in this direction in both contact section, it is because the absolute magnitude of the developer amount of supply to the developer support by developer feed zone material decreases comparatively and the developer layer with the comparatively uniform amount distribution of electrifications is formed. Thus, since the contact pressure to the developer support of layer specification-part material is low voltage comparatively, neither reinforcement nor a mold-release characteristic is required like the layer specification-part material in the conventional developer.

[0012]

[Example] Hereafter, one example which applied this invention to the developer of an electrophotography copying machine is explained. Drawing 1 (a) is the front view showing the outline configuration of the developer concerning this example. The photo conductor drum 1 as latent-image support is for example, peripheral-speed 120 mm/Sec, and a rotation drive is carried out at an arrow-head clockwise rotation. The developer 2 is arranged by the method of right-hand side of this photo

conductor drum 1. In order to carry out an electrophotography process, well-known electrification equipment, exposure optical system, an imprint decollator, cleaning equipment, and an electric discharger (all are un-illustrating) are arranged in the perimeter of the photo conductor drum 1. The casing 3 equipped with opening which turned the developer 2 of this example to photo conductor drum 1 front face, The developing roller 4 by which a part is exposed from this opening and a rotation drive is carried out with a predetermined peripheral speed at an arrow-head counterclockwise rotation, The toner supply roller 5 as developer feed zone material by which a rotation drive is carried out at an arrow-head clockwise rotation where a pressure welding is carried out to the method section of right-hand side of this developing roller 4, With the agitator 6 who agitates the toner of hopper circles while supplying the nonmagnetic toner (henceforth a toner) held in the hopper area constituted by the method section of right-hand side in casing 3 to this feed roller 5 front face It carries out, if it is the thickness which accustoms uniformly the thickness of the toner layer on the developing roller 4 conveyed by rotation of a developing roller 4 to the development field which is the opposite section with the photo conductor drum 1, and it has the plate 8.

[0013] The above-mentioned casing 3 is constituted by configuration in which the inside part of toner supply roller 5 lower part holds the front face of the toner supply roller 5, and a predetermined gap.

[0014] As shown in drawing 1 (a), the above-mentioned developing roller 4 sets and arranges photo conductor drum 1 front face and a predetermined gap, may be made to perform non-contact development, and it is arranged so that the toner layer on a developing roller 4 may contact photo conductor drum 1 front face, and it may be made to perform contact development. The directions of surface migration in a development field are the photo conductor drum 1 and this direction, and rotation of a developing roller 4 is made to become about 120 mm/sec, in order to prevent the phenomenon of the above-mentioned back end toner approach in the case of which when that peripheral speed is uniform velocity, i.e., this example, mostly, the peripheral speed of the photo conductor drum 1, and. However, in contact development, since there is no speed difference that it is entire uniform development between photo conductor drum 1 front face and developing-roller 4 front face, there is a possibility that physical toner adhesion may start, irrespective of the potential of photo conductor drum 1 front face. In order to prevent this, it sets up so that the direction of the peripheral speed of a developing roller 4 may become somewhat quick. For example, 1:1.05-1.1 are desirable at a peripheral-speed ratio (photo-conductor drum 1 peripheral speed: developing-roller 4 peripheral speed). If it is a velocity ratio of this level, the back end toner approach mentioned above is not conspicuous. Moreover, suitable development bias voltage, for example, a direct current, an alternating current, the alternating current of direct-current superposition, a pulse voltage, etc. are impressed to a developing roller 4. It is desirable to impress especially the electrical potential differences (an alternating current, the alternating current of direct-current superposition, or pulse voltage) which have the good alternation component of flight conditions in the case of non-contact development.

[0015] And as a developing roller 4 of this example, it is the purpose of increasing the amount of adhesion toners, and as shown in drawing 2 (a) thru/or (c), it is constituted by the front face so that the dielectric section 41 and the conductor section 42 may carry out mixture exposure in minute area.

Drawing 2 (a) is an explanatory view in which developing-roller 4 front face and (b) show the cross section, and (c) shows the toner stratification condition of the front face, respectively. It is made, as for the magnitude of this dielectric section 41, for a path to be set to about 50-200 micrometers. It is made for such the dielectric section 41 to distribute at random according to a certain regulation. As for the area of the dielectric section 41, it is [Ryobe's surface ratio] desirable to make it become 40 - 70% of range. And what has the resistance which is extent in which a charge is not accumulated by frictional electrification with the above-mentioned toner supply roller 5 as an ingredient of this dielectric section 41 is used. After carrying out knurling tool processing of the front face of a rodding roller and forming a predetermined slot in order to form the surface section like illustration for example, the coat of the insulating resin is carried out, cutting of the front face is carried out after that, and Mizouchi's resin can form, when making it exposed [the rodding section / as the dielectric section 41] to a front face as the conductor section 42, respectively. Moreover, it may replace with drawing 2 (a) thru/or the surface

section structure of (c), and you may make it the surface section structure shown in drawing 3 (a) and (b). It is the explanatory view in which drawing 3 (a) shows the front face of a developing roller, and (b) shows the toner stratification condition of the front face, respectively. After the surface section of this example forms the surface layer which particle size becomes from the conductive ingredient which distributed the dielectric particle which are 50 thru/or 100 micrometers on a rodding roller, it can be formed by carrying out cutting of these surface layers some of if needed.

[0016] As for the above-mentioned toner supply roller 5, it is desirable to adopt the structure of the roller equipped with the sponge layer, the roller in which many fur brushes were implanted so that a toner can be held to the interior near the front face. Moreover, what exists in the middle of a frictional electrification sequence top toner ingredient and developing-roller 4 ingredient is used for the surface quality of the material at least so that a developing roller 4 may be contacted and desired frictional electrification can be given to a toner and a developing roller 4. And a front face carries out rotation of the toner supply roller 5 to the rotation of the forward direction moved in developing-roller 4 front face and this direction in the contact section B with a developing roller 4. As for peripheral speed, it is desirable to set up by about 0.5 to 1.5 times the peripheral speed of a developing roller 4. Moreover, the electrical potential difference same with being impressed by the above-mentioned developing roller 4 may be impressed also to rodding of the toner supply roller 5.

[0017] The above-mentioned agitator 6 agitates this hold toner while supplying the hold toner of hopper circles to toner supply roller 5 front face, but with the configuration of a hopper area, or the fluidity of a toner, by the self-weight of a toner, when supply on toner supply roller 5 front face is possible, he may omit.

[0018] If it is the above-mentioned thickness, a plate 8 becomes [in / carry out and / the direction of developing-roller 4 surface migration] the downstream from the end face section, and a free edge arranges [this free edge] it so that a developing roller 4 may be contacted with the contact pressure which is 10 - 50 gf/cm extent. If it is this thickness, it can carry out and a member 8 can consist of organic or an inorganic ingredient.

[0019] In the above configuration, the hold toner of hopper circles is supplied to toner supply roller 5 front face by the side of a hopper area by the agitator 6. The toner supplied to the toner supply roller 5 adheres to the opening and front face of sponge or a brush, and is conveyed towards the contact section of the toner supply roller 5 and a developing roller 4 by rotation of the clockwise rotation of the toner supply roller 5. On the other hand, the developing-roller 4 surface part which passed through the development field by rotation of the arrow-head counterclockwise rotation of a developing roller 4 also invades into the contact section B with the toner supply roller 5.

[0020] In this contact section B, since toner supply roller 5 front face and developing-roller 4 front face move with a relative-velocity difference The ** toner of the non-image section which remains on developing-roller 4 front face, without adhering to photo conductor drum 1 front face at the time of development field passage It is scratched mechanically and electrically with the toner supply roller 5 (for example, sponge roller), and the charge on a developing roller 4 is also fixed-ized by frictional electrification with the toner supply roller 5, and, thereby, developing-roller 4 front face is initialized. And electrification (in normal development (P/P), it is electrification of a photo conductor charge and like-pole nature, and is electrification of a photo conductor charge and reversed polarity in reversal development (N/P)) of a desired toner electrification polarity and reversed polarity is given to the dielectric section 41 of a developing roller 4 by friction of a developing roller 4, a toner, and the toner supply roller 5, and to drawing 1 (c), as line of electric force E shows, the micro field (closed electric field) is made on a developing roller 4. On the other hand, since the toner feed roller is rotating to the forward direction to a developing roller 4, the toner adhering to the toner supply roller 5 is ****(ed) between a developing roller 4 and the toner supply roller 5, and is charged in the polarity (in normal development, it is a photo conductor charge and reversed polarity, and they are a photo conductor charge and like-pole nature in reversal development) of most request. And the electrification toner on the toner supply roller 5 is attracted electrostatic by the electric field of the micro field on a developing roller 4, and adheres to developing-roller 4 front face at a multilayer. Thereby, a developing roller 4 leaves this

contact section B, where the fully charged toner is supported to a multilayer. In addition, in this example, the non-charged toner from a hopper area is not supplied on the developing roller 4 which passed the contact section B by rotation of the toner supply roller 5 from carrying out order rotation of the toner supply roller 5 and the developing roller 4 unlike the developer concerning the above-mentioned conventional example. This point is explained in full detail behind.

[0021] And if the toner layer on the developing roller 4 which passed the contact section B is the thickness which has contacted lightly on a developing roller 4, it is carried out, and homogeneity controls thickness by the member 8. Since it is set up so that it may carry out if it is the thickness in this example, and the contact force to the developing roller 4 of a member 8 may become about 10-50 gf/cm as mentioned above here, the toner thin layer more than two-layer [by which coating weight was comparatively stabilized also by the environmental variation] can be formed. This point is explained in full detail behind.

[0022] And the toner layer which carried out and passed the member 8 if it was thickness is conveyed to a development field. In a development field, while the front face of a developing roller 4 and photo conductor drum 1 front face where the optimal development bias was impressed by contact or the non-contact developing-negatives method move at uniform velocity mostly, development is performed. In this development field, the electric field in which the conductor section 42 of a developing roller 4 demonstrates the electrode effectiveness, and the toner on a developing roller 4 tends to adhere to the photo conductor drum 1 are also formed.

[0023] Here, stabilization of toner electrification distribution of the developing-roller 4 support toner layer by the toner supply roller 5 and a developing roller 4 carrying out order rotation is explained in full detail. Drawing 4 R> 4 and drawing 5 express typically toner adhesion in each developing roller 4, and an electrification situation a carrying-out-to carrying-out [the toner supply roller 5 (the example of illustration sponge roller) and a developing roller 4]-order rotation case-inverse rotation case. Among drawing, O shows a toner, in O, fills in + and expresses the existence of electrification only with the electrified thing. As shown in drawing 4, in a carrying-out [the toner supply roller 5 and a developing roller 4]-order rotation case, both the electrification toner which has already adhered to the toner supply roller 5, and the non-charged toner newly supplied from the hopper area are conveyed with the toner supply roller 5 by the contact section with a developing roller 4, all toners are charged by friction of both the rollers 4 and 5 in this contact section, and it adheres on a developing roller 4. Since order rotation of the toner supply roller 5 and the developing roller 4 is carried out, the non-charged toner from a hopper area is not supplied on the developing roller 4 which passed this contact section by rotation of the toner supply roller 5. Therefore, since the toner coating weight on the developing roller 4 which passed the contact section is determined with the voidage of the electric field of a developing roller 4, and the sponge roller as a toner supply roller 5 etc., it is comparatively stable. On the other hand, as shown in drawing 5, also when the toner supply roller 5 and a developing roller 4 carry out inverse rotation, both the electrification toner which has already adhered to the toner supply roller 5, and the non-charged toner newly supplied from the hopper area are conveyed with the toner supply roller 5 by the contact section with a developing roller 4. When the new toner (the arrow head of void shows the supply way to toner supply roller 5 front face) especially supplied from the hopper area like the example of illustration is conveyed to the contact section with a developing roller 4 in the condition [having ridden on the toner supply roller 5], comparatively a lot of non-charged toners are conveyed to the entry of the contact section. And the toner which invaded into this contact section and was enough charged by friction of both the rollers 4 and 5 adheres to developing-roller 4 front face positively, and is taken out from this contact section. In addition, the toner which was ridden and conveyed on the toner supply roller 5 to the entry of this contact section and which is not enough as for electrification also adheres on the developing roller 4 after contact section passage according to electrostatic force (gradient force), toner cohesive force, etc. by electric field on a developing roller 4. The amount of the toner which adheres physically according to this toner cohesive force etc. changes a lot in an environment etc. In forming the electric field of the micro field in a front face like the developing roller 4 of this example and forming a toner in a multilayer especially, adhesion of this non-charged toner leads to an unstable toner being attached and

passing.

[0024] If drawing 6 (a) and (b) are each thickness when carrying out inverse rotation to the case where the toner supply roller 5 and a developing roller 4 carry out order rotation, they are carried out, and they show the amount distribution of electrifications of the toner of the toner layer on the developing roller 4 in the location before member 8 passage. With the suction nozzle 9, the support toner on a developing roller 4 is attracted, a multiple-times sampling is carried out, changing distance with developing-roller 4 front face, as shown in drawing 7, and the amount distribution of electrifications of this toner calculates the amount of electrifications and coating weight of a suction toner which were captured by the filter 91 in the suction nozzle 9 in each sampling, and graph-izes this as amount distribution of electrifications in the support toner on a developing roller 4. To a thing with many [when carrying out inverse rotation also from this graph (drawing 6 (b))] non-charged toners, in carrying out order rotation, it turns out that the non-charged toner is decreasing sharply. If drawing 8 (a) and (b) are each layer when carrying out inverse rotation to the case where the toner supply roller 5 and a developing roller 4 carry out order rotation, they are carried out, and they show the amount distribution of electrifications of the toner of the toner layer on the developing roller 4 in the location after member 8 passage. To a thing with many [when carrying out inverse rotation from now on (drawing 8 (b))] non-charged toners, in carrying out order rotation, it turns out that the non-charged toner is decreasing sharply.

[0025] As mentioned above, since coating weight of the toner to a developing roller 4 cannot be easily influenced by the environmental variation and a non-charged toner can acquire the amount distribution of electrifications of few toners when the toner supply roller 5 and a developing roller 4 carry out order rotation, it is very advantageous to the stability of a development property.

[0026] Next, if it is the thickness of this example, it carries out and a member 8 is explained in full detail. In this conventional kind of developer, in order to make suitable thickness of the toner which adheres on a developing roller 4 and is conveyed to a development field, it needed to carry out, if it was thickness, and the contact pressure force to the developing roller 4 of a member needed to be set up comparatively highly. Moreover, when the amount of toner electrifications changed by change of a perimeter environment, the toner amount of supply might change and image concentration might change. On the other hand, since the amount distribution of electrifications becomes homogeneity so that the absolute magnitude of toner supply may become less and it may explain in full detail behind by carrying out order rotation of a developing roller 4 and the toner supply roller 5 as mentioned above in this example, it carries out, if it is thickness, and in a member 8, the excessive contact pressure force is less necessary, and can form a uniform toner layer with the low linear pressure of 50 or less gf/cm. Furthermore, it carries out, if it is thickness even if the toner amount of supply with the toner supply roller 5 increases, and sufficient restraining force can also be demonstrated to pressure fluctuation when it carries out if it was thickness in making the linear pressure of a member 8 into the range of 10 or more gf/cm, and the toner inflow to the contact section of a member 8 and a developing roller 4 increases, it is stabilized, and a uniform toner layer can be formed.

[0027] In addition, drawing 9 takes the temperature of a perimeter environment along an axis of abscissa, if it is thickness, it is made into an axis of ordinate, it takes the toner coating weight (M/A) per unit area on the developing roller 4 after member 8 passage, and shows the relation between perimeter environmental temperature and this toner coating weight. a in drawing shows the experimental data at the time of making it rotate so that a front face may move the toner supply roller 5 to hard flow in the contact section with a developing roller 4 unlike this example. Now, it turns out that this toner coating weight is changed sharply and it separates greatly with the temperature of a perimeter environment from 1 which is the toner coating weight range where especially low temperature is the optimal in ** thru/or 2 mg/cm². And among drawing, although each of b, c, and d carries out order rotation of the toner supply roller 5 like this example, it is the result of experimenting under the conditions from which it carries out if it is the thickness to a developing roller 4, and the contact pressure of a member 8 differs mutually. That is, b is experimental data under the conditions [c / contact pressure / above-mentioned / d / within the limits of 10 thru/or 50 gf/cm, and] with the above-mentioned contact pressure smaller than 10 gf/cm that the above-mentioned contact pressure is larger than 50 gf/cm. Among such b, c, and d, only c was

not based on a temperature change but toner coating weight became the thing of the optimal within the limits. Moreover, in this c, the toner layer by which little amount c/g of 5-8micro of average electrifications of a non-charged toner was stabilized can be obtained. The above thing also shows that a uniform toner layer can be easily formed from it carrying out if it is the toner supply characteristics and thickness of the toner supply roller 5, and the conditions of both of the layer regulation property of a member 8 being proper in this example.

[0028] As mentioned above, what is constituted so that the dielectric section 41 and the grounded conductor section 42 may be intermingled in minute area on a front face as a developing roller 4 according to this example is used. And since it enables it to attract a lot of toners which carried out frictional electrification of this dielectric section 41 with the toner supply roller 5, formed much microelectrodes, and were fully easily charged on the front face of a developing roller 4 by this The multilayer toner layer charged enough can be easily formed on a developing roller 4. Moreover, by carrying out order rotation of the toner supply roller 5 and the developing roller 4, since he is trying not to supply the non-charged toner from a hopper area on the developing roller 4 which passed the contact section B by rotation of the toner supply roller 5 by this, coating weight of the toner to a developing roller 4 cannot be easily influenced by the environmental variation, and the amount distribution of electrifications of a toner with few non-charged toners can be acquired, and a development property can be stabilized. Therefore, since a non-charged toner can stabilize for it and form the multilayer toner layer which has the desired amount of electrifications few on a developing roller 4, uniform development is also attained.

[0029] Moreover, since it can carry out and the contact pressure to the developing roller 4 of a member 8 can be set as low voltage as compared with the former if it is thickness, it carries out, if it is thickness, and the quality of the material of a member is not limited to the ingredient which was excellent in mold-releases characteristic and reinforcement, such as PFA, like before, either. Therefore, metallic materials, such as resin ingredients, such as India rubbers, such as a polyurethane rubber, a fluororubber, and silicone rubber, and SUS, can also be used, and the width of face of ingredient selection spreads. For example, also when the blade which consists of a metal which toner fixing produced by about 1000 A4 copies conventionally, and the vertical stripe on an image generated was used, the same image as the first stage was able to be formed, without being able to carry out a pressure welding to a developing roller 4 with low voltage comparatively according to this example, consequently toner fixing occurring also by 20000 copies.

[0030] Moreover, since it is rotating so that a developing roller 4 may be mostly moved at uniform velocity with the photo conductor drum 1 in a development field, "toner back end approach" does not occur but the good image which does not have the fault of the different colors of the excess of concentration in the back end section or a heavy image at a color picture can be obtained.

[0031] Moreover, since the non-charged toner is not contained in the toner layer on a developing roller 4, the good image quality which neither natural complexion dirt nor resolution degradation also has can be acquired.

[0032] Moreover, since it carries out if it is the thickness which contacts lightly the developing-roller 4 surface part which passed the contact section B with the toner supply roller 5, and thickness of the toner layer which forms a member 8, controls the toner thickness on a roller to homogeneity by this, and is conveyed to a development field is made into homogeneity, the concentration homogeneity of a developed image can be raised and a good solid image can be obtained. It is effective in there being a possibility of producing some coating weight nonuniformity in a developing roller 4, and preventing degradation of the image quality by this coating weight nonuniformity especially, since what is constituted so that the conductor section 42 grounded with the dielectric section 41 on the front face as a developing roller 4 may be intermingled in minute area is used.

[0033] Hereafter, the more concrete mode of this example is explained below.

(1) Developing-roller 4 and a path formed the slot with a depth [of 0.1mm], and a flute width of 0.13mm in the rodding roller front face which is 25mm in the shape of an iris at pitch 0.3mm and 45 include angles by knurling tool processing.

- coated the front face of this rodding roller with fluorine system resin (Asahi Glass Lumiflon LF 200), it was made to dry at 100 degrees C for about 30 minutes, and the dielectric layer coat was given.

- cutting of the front face of this roller was carried out, by making the rodding section into the conductor section 42, it was made to expose to a front face and the fluorine system resin section with which the slot of knurling tool processing was filled up and which remains was made into the dielectric section 41. Conductor section 42 area at this time is 36% of the whole, and the dielectric section 41 was made into 64% of the whole. in addition, surface roughness -- R3 thru/or 20 micrometers -- desirable -- 5 thru/or about 10 micrometers.

(2) It ate away, and in the amount of 1mm, the sponge roller of 14mm of diameters of 107 ohms of surface resistance which carried out toner supply roller 5 and foaming polyurethane carbon sinking-in processing was made to contact a developing roller 4, and has been arranged.

- the electrical potential difference which the 100V potential difference which gives the electrostatic force by the side of a developing roller 4 to the toner which carried out frictional electrification to the predetermined polarity at rodding of this sponge roller between same electrical potential differences or developing rollers 4 as a developing roller 4 produces was impressed.

(3) Contact arrangement of the elastic plate which carries out and consists of polyurethane rubber with a thickness [plate 8 and thickness] of 2mm if it is thickness was carried out by the contact pressure of 10 - 50 g/cm to the developing roller 4.

(4) The AC bias of peak two peak 1000V and 250HZ which superimposed direct-current-500V on development bias, and a development gap and a developing roller 4 was impressed (it may replace with this and the direct-current bias of -50-150V may be impressed).

- The development gap was set as 150 micrometers.

(5) A photo conductor, OPC, and uniform electrification potential were set as -900V.

(6) It considered as the toner, the nonmagnetic styrene acrylic plus electrification toner, and the polar control agent, and SiO₂ impalpable-powder 0.5wt% was *(ed) outside as an external additive using :Nigrosine.

[0034] The toner layer of little amount distribution of electrifications of a non-charged toner was able to be formed within limits with coating weight and the amount of average electrifications proper when the coating weight of the toner layer supported by adhering on the developing roller 4 the above condition etc. is measured. In addition, peak TSUU peak 500V which superimposed direct-current-250V for development gap 0mm contact development as development bias, Using the AC bias (it may replace with this and the direct-current bias of -100-250V may be impressed) of 250HZ(s), other conditions were able to be made the same as the above, and were able to form the good toner like the place which measured the coating weight of the toner layer supported by adhering on the developing roller 4 etc. In addition, when performing contact development in this way, it is desirable to use the elastic roller which has elastic body layers, such as rubber, as a developing roller 4, using a belt-like thing as a photo conductor.

[0035] Moreover, although the above example is a thing in the case of carrying out normal development (development in which a toner is made to adhere to a part with comparatively large potential) of the positive latent image on a negative electrification photo conductor (the part to which a toner should be made to adhere comparing with the natural complexion section, and it being a latent image with large potential) with a forward electrification toner This invention is applicable also to the thing using a polarity reverse as a polarity of each electrification, and the thing which carries out reversal development (development in which a toner is made to adhere to a part with comparatively small potential) of the negative latent image on a photo conductor (the part to which a toner should be made to adhere compares with the natural complexion section, and it is a latent image with small potential).

[0036] Next, other examples of this invention are explained. If this example is the above-mentioned thickness, it is carried out, and it is related with amelioration of a member 8. Sheet metal is needed, in order to carry out and to obtain the low linear pressure to a developing roller 4, using a metal plate as a member 8, if it is the above-mentioned thickness. If a screw is used for the installation to the supporter material which attaches such a metallic thin plate in the casing 3 of a developer, since the metal plate is

thin, it will surely be easy to produce a deflection. Moreover, although such a metallic thin plate is attached to supporter material direct picking, even if it uses binders, such as a double-sided tape, in order not to produce a deflection, a highly precise holddown member and the fixed approach are needed, and it leads to a cost rise etc. And if it was such thickness, when it carries out and a deflection is produced in the metallic thin plate as a member 8, a stripe may occur on an image, without the ability forming a uniform thin layer.

[0037] So, in this example, from environmental capability (there is little deformation) with the passage of time, if it is thickness, it carries out, and as a deflection does not arise, metallic thin plates, such as advantageous SUS as the quality of the material of a member 8 and phosphor bronze, are carried out if it is thickness, and they are used as a member. The member 8 is attached in the supporter material 81 through the elastic body 82, as it is made concrete if it is the thickness which consists of sheet metal of SUS, and shown in drawing 10 (a) and (b). If the outline block diagram of the developer which carries out it if drawing 10 (a) is such thickness, and has a member 8, and drawing 10 (b) are thickness, they are carried out, and they are the enlarged drawing of the anchoring section of a member 8. In addition, points other than the approach carry out it if the developer of this example is thickness, and a member 8 should cling are the same configurations as the example shown in above-mentioned drawing 1, and give the same sign to the corresponding member among drawing.

[0038] According to this, the deflection produced when distortion cannot occur easily, uniform blade thickness can be added in the thrust direction of a developer support member and this pastes up a metallic thin plate on direct supporter material, since the metallic thin plate is pasted up with metal supporter material through elastic bodies, such as rubber of fixed thickness constant width, is canceled, and fixed concentration becomes reproducible. Uniform concentration was able to be obtained by adjusting to the blade thickness of 10 - 30 gf/cm at this time.

[0039] Moreover, as shown in above-mentioned drawing 10 (b), it replaces with arranging so that the elastic body 82 whole may be carried out if it is thickness, and it may be inserted by the member 8 and the supporter material 81, if it is the thickness which becomes the free edge of the elastic body 82 which consists of a rubber plate of fixed thickness (for example, 3 thru/or thickness within the limits of 5mm) in the range which a creep does not generate from a metallic thin plate as shown in drawing 11, it may carry out, and you may attach by attachment using adhesives of a member 8 etc.

[0040] Drawing 12 shows other examples for carrying out, if it is the thickness which consists of a metallic thin plate, and preventing **** generating on the image by the deflection of a member 8. In this example, it was made hard to bend like illustration the tip of the metallic thin plate 8 which consists of SUS, for example, and to bend, and has contacted by making it the dinner pad to a developing roller 5.

[0041] In addition, although a metallic thin plate is carried out if it is thickness, and it is used for each example shown in the above drawing 10 thru/or drawing 12 as an ingredient of a member 8, if deformation, a creep, etc. do not occur in an environment-proof and a passage-of-time-proof property, if it is thickness in the sheet metal which consists of rubber, resin, etc., it may be carried out, it may constitute a member 8, and may adopt as this the approach to the supporter material 81 same with be shown in drawing 10 thru/or drawing 12 "cling" etc.

[0042] Hereafter, the example of each example shown in above-mentioned drawing 10 thru/or above-mentioned drawing 12 is shown.

[Example 1] (drawing 10 (b)) If it was thickness, non-contact reversal development were using the opc drum as a photo conductor 1, and using the negative electrification toner as a developer was performed using the thing between which the elastic body 82 which carries out and consists of weatherproof good ethylene propylene die material (EPDM) rubber and the weatherproof silicone rubber plate of 3 - 5mm thickness between the SUS blade of 0.1mm thickness as a member 8 and the supporter material 81 was made to be placed. The thing which the development gap of 150micro was prepared [thing] by the gap koro between said photo conductors 1 and above-mentioned developing rollers 4, and made direct-current 500V superimpose an alternating current (500HZ1000V) on a developing roller 4 as development bias in the equipment whose VL (exposure section potential) VH (unexposed section potential) of a photo conductor 1 is 1000V, and is 100V was impressed. When negatives were developed

by obtaining the toner layer of coating weight 1.2 mg/cm², and amount c/g of 7micro of electrifications by rotating the toner supply roller 5 in this direction by one 1.2 times the linear velocity of this to a developing roller 4, carrying out if it is thickness, and setting a member 8 as the linear pressure of 15 gf/cm, it excelled in the Sharp nature and the uniform image of the solid section was able to be obtained.

[0043] [Example 2] (drawing 11) If it is thickness, it is made the dinner pad to a developing roller 4 using what stuck the metallic thin plate at the tip of the elastic body 82 which carries out and consists of a rubber plate as a member 8. Contact reversal development using the negative electrification toner as a developer was performed using an opc drum as a photo conductor 1. As a developing roller 4, the photo conductor 1 was contacted in the quality of a conductive member using what has elasticity. In this case, the development potential of 600V is given by impressing 700V as development bias. Like the above-mentioned example 1, when setups developed negatives, the greasing seen by the uniform development of contact to general was not seen, but they reproduced the good image.

[0044] [Example 3] (drawing 12) If it was thickness, it carried out, and as a member 8, the tip of a metallic thin plate was made into bending, the inside was made into the dinner pad, and the developing roller 4 was contacted. The image with a good place which performed the image broth with the equipment set as the conditions as an example 1 that other points are the same was obtained.

[0045] Next, the example of further others of this invention is explained. This example is related with amelioration of the magnitude of the toner supply roller 5. When the toner supply roller 5 is made into a minor diameter and a developer is constituted from a developing roller 4 like the example shown in above-mentioned drawing 1, a toner does not adhere to toner supply roller 5 front face enough with use of equipments, such as development of a solid image, but the amount of supply of the toner to a developing roller 4 runs short, and there is a possibility that the concentration of the back end may become thin rather than the tip on an image. It is effective to speed up rotation of the toner supply roller 5, in order to prevent such fault, and to maintain the amount of supply of a toner. However, in order that the front face of the toner supply roller 5 which has repeated the slide contact to a developing roller 4 by having sped up rotation of the toner supply roller 5 also in this case may carry out early wear, it becomes impossible to maintain the minute electric field formed in developing-roller 4 front face, and the amount of charges of a toner in the time of a path, and the toner amount of supply to a developing roller 4 decreases, and there is a possibility that the new fault that the torque of the whole developer rises may arise.

[0046] Then, this example is for preventing the short supply of the toner to a developing roller 4 by not being based on the operating condition of equipment but maintaining the condition that enough toners for toner supply roller 5 front face have adhered without faults, such as early wear of the toner supply roller 5, and a torque rise of the whole developer.

[0047] For this reason, in this example, as shown, for example in drawing 13, the path of the toner supply roller 5 is constituted so that both path may serve as $dD \leq dS \leq 5$ and dD in it, when the path of dS and a developing roller 4 is set to dD .

[0048] According to this, since the path of the toner supply roller 5 consists of paths of a developing roller 4 greatly, the perimeter of the toner supply roller 5 is longer than before, and surface area is large. For this reason, in order to supply enough toners for a developing roller 4, when the amount to which the toner supply roller 5 ****s a developing roller 4 to per unit time amount is fixed, time amount until the part which performed the once slide contact of the toner supply roller 5 ****s to a degree can be made longer than the conventional example. Therefore, while rotating in toner **** rather than the conventional example, a toner becomes easy to adhere to the toner supply roller 5, and the short supply to a developing roller 4 can be prevented. In addition, the path of the toner supply roller 5 was made into 5 or less times of the path of a developing roller 4 for carrying out, if it is thickness, and fault occurring about the magnitude of installation of a member 8, or the whole developer, when the form of the toner supply roller 5 was too much large.

[0049] In addition, the point C on the developing-roller 4 surface-migration path in which toner supply roller 5 front face touches the developing-roller 4 above-mentioned front face first in each above

example The point B on the developing-roller 4 surface-migration path which is the angle of repose alpha of the toner which the angle beta of Tangent mC and a horizontal line l (horizontal line where the example of illustration passes along the core of a developing roller) to accomplish uses (It is hereafter called the contact start point C) (refer to drawing 14 (a)) (It is hereafter called the resting point B) It is desirable to set up arrangement of the toner supply roller 5 to a developing roller 4 so that it may be located caudad (refer to drawing 14 (b)).

[0050] Hereafter, the reason is explained. Drawing 15 (a) shows an example (henceforth this example) which made the toner supply roller 5 the above-mentioned desirable arrangement, and drawing 15 R> 5 (b) shows an example (henceforth the example of a comparison) which made the toner supply roller 5 the arrangement which is not desirable. Before reaching the contact start point C by rotation also in which example, the toner touches developing-roller 4 front face from from.

[0051] And in the example of a comparison of drawing 15 (b), since arrangement of the toner supply roller 5 is set up so that the contact start point C may become the upper part from the resting point B, by the time developing-roller 4 front face reaches the contact start point C, it will contact a toner from the resting point B even in the upper part. Since slipping does not arise among both in contact on the toner in the upper part, and developing-roller 4 front face from such a resting point B, even a non-charged toner will be supported by developing-roller 4 front face. Thus, even if an electrification toner is succeedingly supplied to developing-roller 4 front face with the toner supply roller 5, and the non-charged toner supported by developing-roller 4 front face before reaching the contact start point C advances into the contact section with the toner supply roller 5 and is rubbed in this contact section, that to which there are too many amounts of toners which advance as compared with the frictional electrification capacity in the contact section, and electrification becomes inadequate produces it. For this reason, a non-charged toner and a low electrification toner are contained so much on the developing roller 4 which passed the contact section, and the fault that this will produce the greasing of an image and decline in the rate of development transition arises.

[0052] On the other hand, since arrangement of the toner supply roller 5 is set up in this example of drawing 15 (a) so that the contact start point C may consist of a resting point B caudad, by the time developing-roller 4 front face reaches the contact start point C, it will not contact a toner, and, thereby, can prevent the above faults. Therefore, the electrification toner suction effectiveness by much minute electric fields on a developing roller 4 also supports a toner with a laminating condition conjointly, and the stable formation of the toner layer of the stable amount of electrifications without a non-charged toner can be carried out.

[0053] For example, the roller with a diameter of 16mm was used for the developing roller 4 at the roller with a diameter of 27mm and the toner supply roller 5, and using that whose angle of repose is 50 degrees as a toner, when the location of the toner supply low roux 5 was made into the upper part like [B point / whose angles of a tangent are 50 angles of repose] the example of a comparison of drawing 15 (b), it became oversupply, and many non-charged toners were contained in the supplied toner. However, when the contact start point C was carried out like this example of drawing 15 (a) more nearly caudad than a B point, the good amount of supply and the amount of electrifications of a toner were able to be obtained.

[0054] Although the example of a nonmagnetic 1 component developer explained the above, it can be adapted like the 1 component developer which was with the magnetic toner.

[0055]

[Effect of the Invention] According to the developer of this invention, as both front faces move in this direction in both contact section in a developer feed zone material front face and a developer support front face, the developer on developer feed zone material is made to adhere to a developer support front face. By this It is made not to supply the non-charged developer from the toner hold section to the developer support front face which passed this contact section directly depending on migration of a developer feed zone material front face. And since only the developer fully charged in the frictional electrification in this contact section is supported with a laminating condition on this front face by the minute electric field near the developer support front face A non-charged toner can form the multilayer

toner layer which has the desired amount of electrifications few on developer support, and can supply latent-image support. Therefore, it becomes possible by performing uniform development to obtain the good developed image from which "toner back end approach" is prevented and the different colors of the excess of concentration of the back end section or a heavy image does not produce a color picture, either. Moreover, since a non-charged toner etc. is not conveyed to a development field, the good developed image which produces neither natural complexion dirt nor resolution degradation can be obtained.

[0056] Moreover, since the developer layer on developer support is made into homogeneity by the layer specification-part material by which the pressure welding of the free edge is carried out to the developer support front face with 10 thru/or the linear pressure of 50 gram-weight/centimeter, and it is made proper developer coating weight also when the amount of developers on the developer support which passed this contact section increases by change of a perimeter environment by this, change of the image by change of a circumference environment can be prevented.

[0057] Moreover, since the contact pressure to the developer support of the above-mentioned thickness specification-part material is small and ends as compared with the former by driving so that a front face may move developer support and developer feed zone material in this direction in both contact section, neither reinforcement nor a mold-release characteristic is required like the layer specification-part material in the conventional developer, and the degree of freedom of material selection becomes large.

[Translation done.]